

FLORA SURVEY FOR THE NUNGATTA FERAL PREDATOR FREE AREA

Jackie Miles, Consultant Botanist
Hawkshead Road, BROGO 2550
Phone: 6492 7285
Email: milesjackie311@gmail.com



Eastern Mantis Orchid, *Caladenia tentaculata*, uncommon on the site.

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NUNGATTA FERAL PREDATOR FREE AREA FLORA SURVEY November 2021

Vegetation surveys were undertaken in the area proposed for use as a feral-free release site for endangered native fauna during November 2021. These took the form of 24 BAM-style quadrats (a 20x20m full floristics plot nested at one end of a 20x50m plot in which structural data was collected), plus random meanders in a few areas selected as being potential habitat for threatened flora species, or with the potential to add more species to the flora list being compiled for the area.

Floristic data from the quadrats is in the VIS database in the survey "Nungatta FPF area flora survey". Additional structural data not catered for in the VIS format has been provided to the Department of Planning and Environment in a spreadsheet. Quadrat location details are appended. Additional quadrat surveys are planned for spring of 2022.

Vegetation communities

The dominant tree species over most of the area are White Stringybark (*Eucalyptus globoidea*), Silvertop Ash (*E. sieberi*) and Yertchuk (*E. considiniana*), with Messmate (*E. obliqua*) also occasionally dominant. Perhaps because of the low relief of much of the area and the relatively high elevation (c. 500-700m ASL) Monkey Gum (*E. cypellocarpa*) is less restricted to drainage lines and sheltered aspects than it usually is, and it can be found scattered through most forest types on the site. Yellow Stringybark (*E. muelleriana*) and Blue-leaved Stringybark (*E. agglomerata*) are also occasionally dominant over small areas.

In the more sheltered parts of the site Apple-topped Box (*E. angophoroides*) may be common, and Ribbon or Manna Gum (*E. viminalis*) and Swamp Gum (*E. ovata*) occur in or near drainage lines. There are scattered occurrences of the peppermint *E. croajingolensis* and in the driest forest type in the north-west corner of the site, occasional Broad-leaved Peppermint (*E. dives*), usually a tablelands species.

Although the forest composition does vary from place to place, it is hard to fit any of it into the communities described for the Eden region by Keith and Bedward (1999). The driest forest type, in which Yertchuk is the dominant tree and the understorey is somewhat heathy in shrub composition best fits their Map Unit 46A, Timbillica Dry Shrub Forest, although it is stated to occur at lower elevations: "low ridges and slopes in undulating granitoids terrain at 50-300m elevation in the middle to lower reaches of the Wallagaraugh River catchment" being the description of its occurrence.

The areas with Silvertop Ash, Messmate or various stringybarks dominant include elements of Map Unit 25 (Sandstone Dry Shrub Forest), Map Unit 26 (Tableland Dry Shrub Forest), Map Unit 29 (Nalbaugh Dry Grass Forest) and Map Unit 30 (Wallagaraugh Dry Grass Forest). These communities all share a lot of species in common, so distinguishing between them is not easy.

The vegetation of broad flat drainage lines is a good fit to Map Unit 17 (Flats Wet Herb Forest), with Swamp Gum or Ribbon Gum and Blackwood (*Acacia melanoxylon*) present over a largely shrub-free understorey of *Lomandra longifolia* with a variety of grasses and forbs typical of wet areas in the inter-tussock spaces.

The smaller and upper parts of the drainage lines close to Imlay Road carry a heathy, largely treeless community which fits Map Unit 56 (Hinterland Heath), said to be dominated by *Allocasuarina paludosa* and *Leptospermum continentale* and occasionally *Callistemon*

citrinus. Patches of the latter tall shrub are quite common at Nungatta, and provide much of the habitat for the threatened *Pultenaea parrisiae*.

One additional community which is present in the north-west corner of the site is a heath dominated by *Allocasuarina nana*, growing in drier situations than the Hinterland Heath community with *A. paludosa* dominant. Only one treeless patch of this was found close to White Rock River, the southern end of the patch being at GDA 709247 5887249, but *A. nana* also extends in under the surrounding forest or woodland as an understorey dominant. The only community described by Keith and Bedward which fits this assemblage is Map Unit 53, Montane Heath, which is usually found at elevations of around 800-1000m along the escarpment in Wadbilliga and Deua National Parks and on ranges to the west such as in Dangelong and Coolumbooka Nature Reserves. It is unusual to find *A. nana* as low as 500m elevation, although not unheard of as it also occurs in Map Unit 54, Mt Nadgee Heath on Table Ridge in Nadgee Nature Reserve at around the same elevation. Mt Nadgee Heath is a much more diverse plant assemblage. This plant community is of some botanical interest due to its unusual low altitude occurrence and different species composition to typical Montane Heath and it would be preferable to avoid putting the boundary fence through this area.

Subsequent comparison of quadrat data with the latest iteration of the Plant Community Types descriptions found on DPE's Bionet database found that the quadrat data fell within, or closest to, the following PCTs.

Wetter communities are either:

3194 South East Escarpment Flats Swamp Gum Forest
 3212 Far South Escarpment Damp Flats Forest
 3451 Far South Sheltered Monkey Gum Forest
 3221 Southern Escarpment Messmate Forest

Drier forest communities include:

3449 Far South Escarpment Stringybark-Gum Forest
 3450 Far South Hinterland Dry Grassy Forest
 3452 South East Hinterland Dry Grassy Forest
 3648 Far South Hinterland Silvertop Ash Forest
 3666 South East Mountain Dry Shrub Forest

The wet heath in which *Pultenaea parrisiae* occurs falls into PCT 3901, Far South Hinterland Heath, while the dry *Allocasuarina nana* community which was not sampled in any quadrats is probably closest, of the 3 southern montane heaths in the PCT classification, to PCT 3874, Monaro Montane Heath. This PCT is based largely on quadrats from Coolumbooka Nature Reserve, which would be the closest occurrence of this community in terms of distance, to the Nungatta stand.

“Missing” species

Some of the species which might have been expected to occur in the types of forest present were not recorded, although as the survey was not exhaustive, some may have just been overlooked. As the vegetation is still in a relatively early stage of fire recovery some may return at a later time. Some of the apparently absent species may be a result of the low relief of most of the site, so that it lacks areas which are topographically protected from fire. Parts of the site were also burnt in a hazard reduction burn in 2016. The lack of fire-protected sites could account for some absences such as vines (wet forest species such as *Marsdenia rostrata* and *Pandorea pandorana*) which are common in most parts of the region, and

rainforest species which may “invade” drier forests in the absence of fire such as *Pittosporum undulatum*, *Myrsine howittiana* and *Elaeocarpus reticulatus*.

In general the diversity of trees, shrubs and groundcover species seems quite high over the whole site, although at any one location it may not be.

The most obvious near-absence is that of grass trees, *Xanthorrhoea* species. The taller trunked species *Xanthorrhoea australis* is generally only found in rocky sites and the area does not have many of these, but the smaller *X. concava* is common throughout the region in drier forest types on low fertility soils. A very few plants of this species were found in the dry forest dominated by Yertchuk in the north-western corner of the site, but it appeared to be absent elsewhere.

In the light of subsequent discovery of *Phytophthora cinnamomi* (Pc) from soil samples within the area, it is possible that *X. concava* has been more widespread in the past in this area. It can reasonably be assumed that Pc was introduced and spread during logging of the area, which may have occurred up to a couple of decades previously. This would be ample time to allow the small bodies of *X. concava* to die and break down. Even the larger, trunked *X. australis* break down within a couple of years once they have died (Keith McDougall, pers. comm.).

Another odd apparent absence is Black She-oak, *Allocasuarina littoralis*, another almost ubiquitous species in the understorey of far south coast forests. Although it is fire sensitive, no obvious fire-killed adults, nor any seedlings were recorded during the initial surveys, although one seedling was seen near Imlay Road on a subsequent visit.

None of the Keith and Bedward vegetation communities mentioned above as being likely descriptors of the Nungatta vegetation (Map Units 25, 26, 29 and 30) include *A. littoralis* in their lists of indicator species, so it may just be that this species is uncommon to absent at this elevation, despite being very common on the coast and patchily present at higher elevations on the escarpment and tablelands.

No mistletoes were seen, but this may be largely as a consequence of the 2020 fire. Red Box (*Eucalyptus polyanthemos* ssp. *vestita*) was seen to occur just to the south-east of the site, but not found on it.

The absence of some of these species may have implications for the value of the site as fauna habitat. For example, in coastal forests bandicoot diggings are very commonly seen under Black Sheoak stands, and the absence of this species may mean that some food item commonly searched for by bandicoots is also absent, as well as the obvious lack of food for the Glossy Black Cockatoo.

Threatened species and communities

One listed threatened species, Parris' Bush-pea (*Pultenaea parrisiae*), was known to occur close by on the northern side of Imlay Road, with potential habitat (flat moist to boggy upper drainage lines with heathy vegetation) present on the site, so targeted surveys were undertaken in some but not all suitable habitat patches. A total of at least 1000 plants of this species were found in the area, in addition to the approximately 880 plants found north of Imlay Road this season. All of the sites where this species was found are in the northern part of the proposed feral free enclosure, within 500m of Imlay Road and some are very close to Imlay Road, with the result that siting the northern section of the fence without damaging the boggy habitat of this species may be complicated.

The entire site was burnt in the 2019-20 “Black Summer” fires, at variable intensity with a few patches still having an intact canopy. A useful feature of these fires was that as the landscape was extremely dry at the time wet areas which would normally act as firebreaks were burnt right through, so virtually all the drainage lines were burnt. This fact has probably contributed to the large population numbers of *Pultenaea parrisiae* this season.

No other listed threatened flora species were considered likely to occur in the area. There are records nearby of other species (*Grevillea acanthifolia* ssp. *paludosa*, *Boronia deanei*, *Nematolepis rhytidophylla*), but these are from the more elevated and wetter Nalbaugh Plateau. There does not appear to be any suitable habitat for them on the site.

There are some regionally rare species recorded from the Nungatta area (Keith and Ashby 1992) such as *Pomaderris eriocephala*, *P. angustifolia* and *P. pauciflora* from Nungatta National Park in the vicinity of White Rock Falls. Rocky habitat in the form of three elevated granite knolls within the proposed feral free area was checked for such species and none were found. Some rocky habitat along Reef Creek was sampled but not checked thoroughly, and this could be an area deserving of a little more survey.

The presence of *Allocasuarina nana* heath in the north-west section of the site raised the possibility that some of the threatened or ROTAP species associated with it could occur, but a reasonably thorough search found no sign of these (*Westringia kydrensis*, *Dampiera fusca*, *Haloragodendron monospermum*, *Euryomyrtus denticulata*).

None of the widespread forest types on the site are listed as Threatened Ecological Communities. Forest communities found on drainage lines have the potential to fall within the definition of the TEC River-flat Eucalypt Forest on Coastal Floodplains. Although the description of this TEC includes a rather broad definition of a floodplain (“*the ecological community is associated with silts, clay-loams and sandy loams, on periodically inundated alluvial flats, drainage lines and river terraces associated with coastal floodplains. Floodplains are level landform patterns on which there may be active erosion and aggradation by channelled and overbank stream flow with an average recurrence interval of 100 years or less*”). This is broad enough to include intermittent flat terraces along the larger creeks on the site such as Reef Creek, Sandy Creek and Donald Laing’s Creek. However the Final Determination to list this TEC in NSW goes on to say that “*River-Flat Eucalypt Forest on Coastal Floodplains generally occurs below 50 m elevation, but may occur on localised river flats up to 250 m above sea level.*” As the site is mostly around 500-700m ASL, with none of the drainage lines lower than 400m ASL it is outside the range described in the Final Determination. The TEC listing is really intended to protect over-cleared communities within fertile landscapes used for farming and urban development in the lower parts of catchments, and the site is not in that part of the landscape, being part of the upper catchment of the Genoa River.

Orchids

Special mention should be made of the orchid flora of the site, which appears to be unusually diverse. At least 21 orchid species were encountered during the surveys, with another (*Caladenia congesta*) seen on the northern side of Imlay Road during *Pultenaea parrisiae* searches, which might well also be present in the feral free site. Some were only recorded as leaves so could only be identified to genus (*Acianthus*, *Corybas*, *Chiloglottis*, *Pterostylis*) while 17 orchids were flowering during the survey period. The large number of species is likely to be partially a consequence of the fires and the subsequent two wet years providing optimal conditions for many orchids.

The orchid expert David Jones also visited the site and reported that one of the Sun Orchid (*Thelymitra*) species present may be an undescribed species and that an unusual Onion

Orchid (*Microtis*) species is present, which could also be undescribed. He detected a third Sun Orchid species, *Thelymitra juncifolia*, in addition to the *T. ixioides* and *T. pauciflora* which I recorded.

Included in the orchid flora are five species of *Caladenia*, three species of Bearded Orchids (*Calochilus*), two species of *Glossodia* and two *Diuris* species. Some species were extremely common, particularly the Tiger Orchid (*Diuris sulphurea*) and Flying Duck Orchid (*Caleana major*). Although both of these are common and widespread species, it is unusual to see them in such profusion.

The fact that orchids are so abundant suggests the presence of a diversity of fungi on the site. The following is taken from a Field Guide to Orchids of the Southern Tablelands of NSW including the ACT.

“The orchid life cycle starts when an orchid seed is inoculated by a mycorrhizal fungus. Mycorrhizae are symbiotic associations between a fungus and a plant in which the fungus colonises the plant’s root tissues. Orchid seeds are minuscule and lack any nutrients, therefore a fungus is required to provide nutrients so that the orchid seed can germinate and grow. Most orchids associate with mycorrhizal fungi in the families Ceratobasidiaceae, Sebacinaceae and Tulasmellaceae. Some orchid species only associate with one species of fungus, (e.g. many *Caladenia*) whereas others can use a wide range of fungal partners (e.g. some *Prasophyllum*).”

This source also states that orchid diversity is a good indicator of ecosystem health.

Weeds

Exotic species are uncommon on the site, and are mostly present as a result of the fires, in the form of transient infestations of wind-dispersed weeds in the daisy (Asteraceae) family, such as Fleabane (**Conyza* sp.), thistles (**Cirsium vulgare*, **Sonchus* spp.) and Fireweed (**Senecio madagascariensis*). The latter very invasive species has unfortunately taken advantage of the fires to extend its range out of the farming areas into adjacent forested country, but it is to be hoped that it will not persist once the native vegetation recovers.

Pine wildings from nearby plantations to the west were common in this area, but most of them appear to have been killed by the fire, with no sign of any recruitment. Blackberry was recorded as only a few small plants.

Potential impacts from the proposal

It is likely that the disturbance to vegetation and soil involved in constructing the fence and additional maintenance tracks on the site, plus the increased use for vehicles monitoring the fence and removing feral fauna will result in the creation of good conditions for weed invasion and the introduction of weeds which are not currently present on the site.

Every effort should be made to avoid this, as for example by washing machinery and vehicles to be used on the site. It might be possible to install a drive through wash pit at the entrance to the site.

Some indication of the presence of the root rot fungus *Phytophthora* sp. has already been noted on the site by Naveed Davoodian, as part of the fungi survey which occurred alongside this flora survey. Further soil testing will be required to determine how extensively this is distributed through the site. There was no obvious evidence of its presence in the vegetation such as dying plants in susceptible families such as peas, wattles and Proteaceae (*Hakea*, *Persoonia*, *Banksia*). However, as the vegetation was in early stages of fire recovery, the

impacts of *Phytophthora* might not appear till later. The near-absence of Grass Trees, *Xanthorrhoea* spp., from the site is unlikely to be attributable to the presence of *Phytophthora*, as although this is a very susceptible genus, there are usually dead remains of the plants to be found in areas where a population has been affected by *Phytophthora*. However, if the pathogen was introduced up to twenty years ago, then it is possible any such remains would have been broken down and disappeared by now.

Use of machinery and vehicles on the site also has the potential to introduce or spread *Phytophthora*, so further surveys for this pathogen should be done in the areas the fence is proposed to traverse prior to any work being done on fence construction. Expert advice should be sought on how many such tests would be needed and where in the landscape would be the best place to take samples from.

Spread of *Phytophthora* within the site has the potential to reduce its value for some of the fauna being considered for release there, such as the Smoky Mouse, which takes a large proportion of its food from susceptible families such as peas, wattles and epacrids.

Apart from potential introduction and spread of soil pathogens and weed seed, the proposal should have minimal significant environmental impacts if the fence route can be kept out of the boggy drainage lines close to Imlay Road which are the habitat of *Pultenaea parrisiae*. It would also be preferable to avoid clearing the *Allocasuarina nana* dry heath near White Rock River in the north-western corner of the site, though it does not carry any listed threatened species.

The fence alignment has been designed to make maximum use of existing tracks and old logging trails which can be restored to use, and to pass mostly through areas of logging regrowth rather than old growth. It is likely that some big trees will need to be removed to provide the width of clearing necessary to protect the fence from damage by falling trees or limbs, but this will be minimised as much as possible.

The eradication of feral animals, foxes, cats, deer and pigs, is likely to have a beneficial impact on the flora. Pigs are a particular threat to *Pultenaea parrisiae* and are likely to be significant spreaders of *Phytophthora* due to their digging activity. A possible negative impact could be large increases in populations of the larger native herbivores such as wallabies and wombats due to reduced predation of young animals, which could increase browsing pressure on the vegetation. This possible effect may need to be dealt with in the future, by reintroducing the Dingo, or occasional culling of some of the larger herbivores.

The release of endangered native fauna such as the Long-footed Potoroo, Bettong, Smoky Mouse and Eastern Quoll is also likely to be beneficial in the long term, since it is hypothesised that digging by smaller native fauna provides the soil disturbance necessary for recruitment of some native plants. They also disperse the spores of fungi which have symbiotic relationships with plants, potentially increasing ecosystem health. The vegetation monitoring program will contribute to testing whether this is in fact the case. A possible negative effect of their presence is that if new weeds are introduced to the site during its development, soil disturbance by the fauna could enable the weeds to spread further into the forest than they otherwise might. Typically, except after major disturbances such as the 2020 fires, most weeds do not spread very far from roads within continuously forested landscapes.

References

Egan, J, Wood, T, Farrow, R and Hayashi, T (2020) Field Guide to Orchids of the Southern Tablelands of NSW including the ACT. Published by the authors.

Keith, D and Ashby, E. (1992) Vascular Plants of Conservation Significance in the South East Forests of New South Wales. Occasional Paper No. 11. NSW National Parks and Wildlife Service.

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COMPOSITE SPECIES LIST BASED ON QUADRATS AND RANDOM MEANDERS

Abundance: C = common and widespread; U = uncommon;
R = rare and/or restricted to specific habitats

*Introduced species are preceded by an asterisk.

Species which have had a recent change in the scientific name have the old name in parentheses. Species for which the identification is only tentative are preceded by a ?.

Scientific name	Common name	Family	Abundance
TREES			
<i>Acacia dealbata</i> ssp. <i>dealbata</i>	Silver Wattle	Fabaceae	U
<i>Acacia falciformis</i>	Broad-leaved Hickory	Fabaceae	U
<i>Acacia mearnsii</i>	Black Wattle	Fabaceae	C
<i>Acacia melanoxylon</i>	Blackwood	Fabaceae	R (wet)
<i>Eucalyptus agglomerata</i>	Blue-leaved Stringybark	Myrtaceae	U
<i>Eucalyptus angophoroides</i>	Apple-topped Box	Myrtaceae	C
<i>Eucalyptus consideniana</i>	Yertchuk	Myrtaceae	C
<i>Eucalyptus croajingolensis</i>	Gippsland Peppermint	Myrtaceae	U
<i>Eucalyptus cypellocarpa</i>	Monkey Gum	Myrtaceae	C
<i>Eucalyptus dives</i>	Broad-leaved Peppermint	Myrtaceae	U
<i>Eucalyptus elata</i>	River Peppermint	Myrtaceae	U
<i>Eucalyptus globoidea</i>	White Stringybark	Myrtaceae	C
<i>Eucalyptus ?globulus</i>	Tasmanian Blue Gum	Myrtaceae	R (log dump)
<i>Eucalyptus muelleriana</i>	Yellow Stringybark	Myrtaceae	C
<i>Eucalyptus obliqua</i>	Messmate	Myrtaceae	C
<i>Eucalyptus ovata</i>	Swamp Gum	Myrtaceae	R (wet)
<i>Eucalyptus sieberi</i>	Silvertop Ash	Myrtaceae	C
<i>Eucalyptus viminalis</i>	Ribbon or Manna Gum	Myrtaceae	R (wet)
SHRUBS, SUB-SHRUBS			
<i>Acacia gunnii</i>	Ploughshare Wattle	Fabaceae	R
<i>Acacia myrtifolia</i>	Red-stemmed Wattle	Fabaceae	U
<i>Acacia obtusifolia</i>		Fabaceae	U
<i>Acacia terminalis</i>	Sunshine Wattle	Fabaceae	C
<i>Acacia ulicifolia</i>	Prickly Wattle	Fabaceae	U
<i>Acacia</i> sp.	Unidentified seedlings	Fabaceae	U
<i>Allocasuarina nana</i>	Dwarf Sheoak	Casuarinaceae	R
<i>Allocasuarina paludosa</i>	Dwarf Sheoak	Casuarinaceae	R (wet)

Scientific name	Common name	Family	Abundance
<i>Amperea xiphoclada</i> var. <i>xiphoclada</i>		Euphorbiaceae	C
<i>Banksia marginata</i>		Proteaceae	U
<i>Bedfordia arborescens</i>	Blanket Leaf	Asteraceae	U
<i>Bossiaea buxifolia</i>		Fabaceae	U
<i>Bossiaea prostrata</i>		Fabaceae	U
<i>Brachyloma daphnoides</i>	Daphne Heath	Ericaceae	U
<i>Bursaria spinosa</i> ssp. <i>lasiophylla</i>	Blackthorn	Pittosporaceae	U
<i>Callistemon citrinus</i>	Crimson Bottlebrush	Myrtaceae	C (wet)
<i>Cassinia aculeata</i>	Dolly Bush	Asteraceae	U
<i>Cassinia longifolia</i>	Dogwood	Asteraceae	C
<i>Cassinia trinerva</i>	Dogwood	Asteraceae	R
<i>Coprosma quadrifida</i>	Prickly Currant Bush	Rubiaceae	R (sheltered)
<i>Correa reflexa</i> var. <i>reflexa</i>	Common Correa	Rutaceae	R (rock)
<i>Daviesia latifolia</i>		Fabaceae	C
<i>Daviesia mimosoides</i> ssp. <i>mimosoides</i>		Fabaceae	C
<i>Dillwynia glaberrima</i>		Fabaceae	U
<i>Epacris impressa</i>	Common Heath	Ericaceae	C
<i>Exocarpos strictus</i>	Pale-fruited Ballart	Santalaceae	U
<i>Gompholobium huegelii</i>		Fabaceae	U
<i>Goodia lotifolia</i>	Goldentip	Fabaceae	C
<i>Hakea eriantha</i>	Tree Hakea	Proteaceae	U
<i>Hibbertia aspera</i>	Guineaflower	Dilleniaceae	U
<i>Hibbertia empetrifolia</i>	Guineaflower	Dilleniaceae	U
<i>Hibbertia obtusifolia</i>	Guineaflower	Dilleniaceae	C
<i>Hovea heterophylla</i>		Fabaceae	U
<i>Indigofera australis</i>	Austral Indigo	Fabaceae	C
<i>Kunzea ericoides</i>	Burgan, 'teatree'	Myrtaceae	C (wet)
<i>Leptospermum continentale</i>	Prickly Teatree	Myrtaceae	U (wet)
<i>Leptospermum scoparium</i>	Manuka	Myrtaceae	U (wet)
<i>Leucopogon affinis</i> (<i>lanceolatus</i>)		Ericaceae	C
<i>Lomatia ilicifolia</i>	Holly-leaved Lomatia	Proteaceae	U
<i>Monotoca scoparia</i>	Prickly Broom Heath	Ericaceae	C
<i>Olearia alpicola</i>		Asteraceae	U (wet)
<i>Olearia argophylla</i>	Musk Daisy Bush	Asteraceae	U
<i>Olearia erubescens</i>		Asteraceae	C
<i>Olearia lirata</i>		Asteraceae	U
<i>Oxylobium arborescens</i>	Tall Shaggy Pea	Fabaceae	U
<i>Ozothamnus argophyllus</i>	Spicy Everlasting	Asteraceae	U
<i>Persoonia linearis</i>	Narrow-leaved Geebung	Proteaceae	C
<i>Platysace lanceolata</i>		Apiaceae	C
<i>Podolobium ilicifolium</i>	Holly-leaf Pea	Fabaceae	U
<i>Polyscias sambucifolia</i> ssp. A		Araliaceae	U
<i>Pomaderris ferruginea</i>		Rhamnaceae	U
<i>Pultenaea parrisiae</i>		Fabaceae	R (wet)
<i>Pultenaea retusa</i>		Fabaceae	C
<i>Rubus parvifolius</i>	Small-leaved Bramble	Rosaceae	U (sheltered)

Scientific name	Common name	Family	Abundance
<i>*Rubus fruticosus</i>	Blackberry	Rosaceae	R (wet)
<i>Solanum vescum</i>		Solanaceae	R
<i>Tetradlea bauerifolia</i>	Black-eyed Susan	Tremandraceae	U
FERNS			
<i>Adiantum aethiopicum</i>	Maidenhair	Adiantaceae	U
<i>Asplenium flabellifolium</i>	Necklace Fern	Aspleniaceae	U (rocks)
<i>Blechnum nudum</i>	Water Fern	Blechnaceae	R (wet)
<i>Calochlaena dubia</i>	Common Ground Fern	Dicksoniaceae	U
<i>Cheilanthes austrotenuifolia</i>		Sinopteridaceae	R (rocks)
<i>Cheilanthes sieberi</i> ssp. <i>sieberi</i>	Rock or Mulga Fern	Sinopteridaceae	R (rocks)
<i>Cyathea australis</i>	Rough Tree Fern	Cyatheaceae	U
<i>Dicksonia antarctica</i>	Soft Tree Fern	Dicksoniaceae	U
<i>Hypolepis glandulifera</i>	Sticky False Bracken	Dennstaedtiaceae	U
<i>Hypolepis muelleri</i>	Harsh Ground Fern	Dennstaedtiaceae	U
<i>Lindsaea linearis</i>	Screw Fern	Lindsaeaceae	C
<i>Lycopodium deuterodensum</i>	Bushy Clubmoss	Lycopodiaceae	U
<i>Pellaea falcata</i>	Sickle Fern	Sinopteridaceae	U
<i>Polystichum proliferum</i>	Mother Shield Fern	Dryopteridaceae	U
<i>Pteridium esculentum</i>	Bracken	Dennstaedtiaceae	C
VINES AND TWINERS			
<i>Billardiera mutabilis</i> (<i>scandens</i>)	Apple Berry	Pittosporaceae	C
<i>Calystegia marginata</i>	Forest Bindweed	Convolvulaceae	R
<i>Cassytha glabella</i> forma <i>dispar</i>	Devil's Twine	Lauraceae	C
<i>Cassytha melantha</i>	Devil's Twine	Lauraceae	C
<i>Clematis aristata</i>	Old Man's Beard	Ranunculaceae	U
<i>Clematis glycinoides</i>	Old Man's Beard	Ranunculaceae	U
<i>Comesperma volubile</i>	Love Creeper	Polygalaceae	U
<i>Eustrephus latifolius</i>	Wombat Berry	Luzuriagaceae	U
<i>Glycine clandestina</i>	Twining Glycine	Fabaceae	C
<i>Hardenbergia violacea</i>	Native Sarsaparilla	Fabaceae	C
<i>Kennedia prostrata</i>	Running Postman	Fabaceae	R rocks)
<i>Tylophora barbata</i>		Asclepidiaceae	U
FORBS			
<i>Acianthus</i> sp.	Gnat Orchid	Orchidaceae	U
<i>Arthropodium</i> sp.	Vanilla Lily	Anthericaceae	U
<i>Asperula conferta</i>	Common Woodruff	Rubiaceae	U
<i>Asperula scoparia</i>	Prickly Woodruff	Rubiaceae	U
<i>Brachyscome spathulata</i>		Asteraceae	C
<i>Burchardia umbellata</i>	Milkmaids	Colchicaceae	C
<i>Caladenia carnea</i>	Pink Fingers	Orchidaceae	C
<i>Caladenia clarkiae</i>		Orchidaceae	U
<i>Caladenia fuscata</i>		Orchidaceae	C
<i>Caladenia moschata</i>		Orchidaceae	U
<i>Caladenia tentaculata</i>		Orchidaceae	U
? <i>Corybas</i> sp.		Orchidaceae	U
<i>Caleana major</i>	Flying Duck Orchid	Orchidaceae	C
<i>Calochilus campestris</i>	Bearded Orchid	Orchidaceae	U
<i>Calochilus paludosus</i>		Orchidaceae	U

Scientific name	Common name	Family	Abundance
<i>Calochilus robertsonii</i>		Orchidaceae	U
<i>Cardamine paucijuga</i>	Bittercress	Brassicaceae	U (wet)
<i>Centella asiatica</i>	Pennywort	Apiaceae	U (wet)
* <i>Centaurium ?erythraea</i>	Centaury	Gentianaceae	R (rocks)
* <i>Cerastium glomeratus</i>	Mouse-ear Chickweed	Caryophyllaceae	U
<i>Chiloglottis ?valida</i>	Bird Orchid	Orchidaceae	U
<i>Chiloglottis</i> sp.	Bird Orchid	Orchidaceae	C
* <i>Cirsium vulgare</i>	Black or Spear Thistle	Asteraceae	U
<i>Coronidium (Helichrysum) scorpioides</i>	Button Everlasting	Asteraceae	C
<i>Craspedia ?variabilis</i>	Billy Buttons	Asteraceae	U
<i>Crassula sieberiana</i>	Australian Stonecrop	Crassulaceae	R (rocks)
<i>Cymbonotus lawsonianus</i>	Bear's Ear	Asteraceae	U
<i>Cymbonotus preissianus</i>	Bear's Ear	Asteraceae	U
<i>Cynoglossum australe</i>	Hound's Tongue	Boraginaceae	U
<i>Dianella caerulea</i> var. <i>caerulea</i>	Blue Flax Lily	Phormiaceae	C
<i>Dianella revoluta</i> var. <i>revoluta</i>	Blue Flax Lily	Phormiaceae	U
<i>Dianella tasmanica</i>	Blue Flax Lily	Phormiaceae	U
<i>Dichondra repens</i>	Kidney Weed	Convolvulaceae	U
<i>Diplarrena moraea</i>	White Iris	Iridaceae	U
<i>Diuris ?maculata</i>	Leopard Orchid	Orchidaceae	U
<i>Diuris sulphurea</i>	Tiger Orchid	Orchidaceae	C
<i>Drosera auriculata</i>	Sundew	Droseraceae	U
<i>Drosera peltata</i> s. str.	Sundew	Droseraceae	U (wet)
<i>Drosera spatulata</i>		Droseraceae	U (wet)
<i>Einadia nutans</i>	Climbing Saltbush	Chenopodiaceae	U
<i>Epilobium</i> sp.	Willow Herb	Onagraceae	U
* <i>Erigeron (Conyza) sumatrensis</i>	Tall Fleabane	Asteraceae	U
<i>Euchiton japonicus (gymnocephalus)</i>	Slender Cudweed	Asteraceae	U
<i>Euchiton sphaericus</i>		Asteraceae	U
* <i>Facelis retusa</i>		Asteraceae	U
<i>Galium binifolium</i>		Rubiaceae	C
<i>Galium gaudichaudii</i>		Rubiaceae	C?
<i>Galium leiocarpum (propinquum)</i>		Rubiaceae	U (sheltered)
* <i>Gamochoeta americana</i>	Cudweed	Asteraceae	U
* <i>Gamochoeta calviceps</i>	Silver Cudweed	Asteraceae	U
<i>Geranium gardneri</i>		Geraniaceae	U
<i>Geranium homeanum</i>		Geraniaceae	U
<i>Geranium potentilloides</i> var. <i>potentilloides</i>		Geraniaceae	C (sheltered)
<i>Geranium solanderi</i>		Geraniaceae	U
<i>Glossodia major</i>	Waxlip Orchid	Orchidaceae	U
<i>Glossodia minor</i>	Small Waxlip Orchid	Orchidaceae	U
<i>Gonocarpus micranthus</i>	Swamp Raspwort	Haloragaceae	R (wet)
<i>Gonocarpus tetragynus</i>	Raspwort	Haloragaceae	C
<i>Goodenia ovata</i>		Goodeniaceae	U

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<i>Gratiola peruviana</i>	Brooklime	Scrophulariaceae	R (wet)
<i>Helichrysum leucopsideum</i>		Asteraceae	U
<i>Hydrocotyle acutiloba</i>		Apiaceae	U (sheltered)
<i>Hydrocotyle hirta</i>		Apiaceae	U
<i>Hydrocotyle laxiflora</i>	Stinking Pennywort	Apiaceae	C
<i>Hydrocotyle sibthorpioides</i>		Apiaceae	U (wet)
<i>Hydrocotyle tripartita</i>		Apiaceae	U (wet)
<i>Hypericum gramineum</i>	Native St John's Wort	Clusiaceae	C
<i>Hypericum japonicum</i>		Clusiaceae	R (wet)
* <i>Hypochaeris glabra</i>		Asteraceae	R (rocks)
* <i>Hypochaeris radicata</i>	Cat's Ear, Flatweed	Asteraceae	U
<i>Lagenophora sublyrata</i> (<i>gracilis</i>)	Small Blue Bottle Daisy	Asteraceae	C
<i>Lagenophora stipitata</i>	Blue Bottle Daisy	Asteraceae	C
* <i>Leontodon saxatilis</i> (<i>taraxacoides</i>)	Lesser Hawkbit	Asteraceae	U
<i>Lycopus australis</i>	Australian Gypsywort	Lamiaceae	R (wet)
<i>Opercularia aspera</i>	Stinkweed	Rubiaceae	C
<i>Opercularia varia</i>	Twiggy Stinkweed	Rubiaceae	C
<i>Oxalis</i> sp.		Oxalidaceae	C
<i>Patersonia fragilis</i>	Purple Flag	Iridaceae	U (wet)
<i>Patersonia sericea</i> var. <i>sericea</i>	Purple Flag	Iridaceae	U
<i>Pelargonium inodorum</i>	Native Storksbill	Geraniaceae	U
<i>Persicaria decipiens</i>	Knotweed	Polygonaceae	R (wet)
<i>Plantago debilis</i>	Native Plantain	Plantaginaceae	C
<i>Plantago varia</i>	Native Plantain	Plantaginaceae	C
<i>Pomax umbellata</i>		Rubiaceae	U
<i>Poranthera microphylla</i>		Euphorbiaceae	C
* <i>Prunella vulgaris</i>	Self-heal	Lamiaceae	R (wet)
<i>Pseudognaphalium</i> <i>luteoalbum</i>	Jersey Cudweed	Asteraceae	R (wet)
<i>Pterostylis falcata</i>	Greenhood	Orchidaceae	R (wet)
<i>Pterostylis</i> sp.	Greenhood	Orchidaceae	U
<i>Ranunculus plebeius</i>	Common Buttercup	Ranunculaceae	U (wet)
<i>Ranunculus sessiliflorus</i> var. <i>sessiliflorus</i>		Ranunculaceae	R
<i>Rhytidosporum procumbens</i>		Pittosporaceae	U
<i>Rumex brownii</i>	Native Dock	Polygonaceae	U
<i>Scaevola aemula</i>	Fanflower	Goodeniaceae	R
<i>Senecio ?diaschides</i>		Asteraceae	R
<i>Senecio hispidulus</i>	Hill Fireweed	Asteraceae	R
<i>Senecio linearifolius</i>		Asteraceae	U
* <i>Senecio madagascariensis</i>	Fireweed	Asteraceae	U
<i>Senecio minimus</i>		Asteraceae	C
<i>Senecio prenanthoides</i> (sp. E)		Asteraceae	C
<i>Senecio quadridentatus</i>	Cotton Fireweed	Asteraceae	R
<i>Sigesbeckia orientalis</i>	Indian Weed	Asteraceae	R
<i>Solanum opacum</i>		Solanaceae	R
<i>Solanum prinophyllum</i>	Prickly Nightshade	Solanaceae	R

Scientific name	Common name	Family	Abundance
* <i>Sonchus asper</i>	Prickly Sow Thistle	Asteraceae	U
* <i>Sonchus oleraceus</i>	Sow Thistle	Asteraceae	R
<i>Stackhousia monogyna</i>	Creamy Candles	Stackhousiaceae	U
<i>Stellaria angustifolia</i>	Swamp Starwort	Caryophyllaceae	R (wet)
<i>Stellaria flaccida</i>	Forest Starwort	Caryophyllaceae	C (sheltered)
<i>Stellaria multiflora</i>		Caryophyllaceae	R (rocks)
<i>Stellaria pungens</i>	Prickly Starwort	Caryophyllaceae	C (sheltered)
<i>Stylidium armeria</i>	Trigger Plant	Stylidiaceae	R
<i>Stypandra glauca</i>	Nodding Blue Lily	Anthericaceae	R
<i>Thelionema caespitosum</i>		Phormiaceae	R
<i>Thelymitra ixioides</i>	Spotted Sun Orchid	Orchidaceae	C
<i>Thelymitra ?pauciflora</i>	Sun Orchid	Orchidaceae	U
<i>Thysanotus patersonii</i>	Twining Fringe Lily	Anthericaceae	R
<i>Thysanotus tuberosus</i>	Common Fringe Lily	Anthericaceae	U
* <i>Trifolium repens</i>	White Clover	Fabaceae	R (wet)
<i>Veronica calycina</i>	Hairy Speedwell	Scrophulariaceae	U
<i>Veronica (Derwentia) perfoliata</i>	Digger's Speedwell	Scrophulariaceae	U
<i>Viola betonicifolia</i>	Narrow-leaved Violet	Violaceae	U
<i>Viola hederacea</i>	Ivy-leaved Violet	Violaceae	C
<i>Viola</i> sp. nov.		Violaceae	C (wet)
<i>Wahlenbergia gracilis</i>	Sprawling Bluebell	Campanulaceae	C
<i>Wahlenbergia ?graniticola</i>	Granite Bluebell	Campanulaceae	C
<i>Wahlenbergia stricta</i> ssp. <i>stricta</i>	Tall Bluebell	Campanulaceae	U
<i>Wurmbea biglandulosa</i>	Early Nancy	Colchicaceae	R (wet)
<i>Xanthosia dissecta</i>		Apiaceae	C (wet)
<i>Xerochrysum bracteatum</i>	Common Everlasting	Asteraceae	U
<i>Xerochrysum viscosum</i>	Sticky Everlasting	Asteraceae	R (rocks)
GRASSES			
* <i>Aira</i> sp.	Hair Grass	Poaceae	U (rocks)
<i>Anthosachne scabra (Elymus scaber)</i>	Common Wheatgrass	Poaceae	R
<i>Austrostipa rudis</i>		Poaceae	U
<i>Austrostipa</i> sp.		Poaceae	U
<i>Deyeuxia decipiens</i>		Poaceae	U
<i>Deyeuxia quadriseta</i>		Poaceae	U
<i>Dichelachne inaequiglumis</i>		Poaceae	U
<i>Dichelachne micrantha</i>	Common Plume Grass	Poaceae	U
<i>Echinopogon caespitosus</i>	Hedgehog Grass	Poaceae	U
<i>Echinopogon ovatus</i>	Hedgehog Grass	Poaceae	U
<i>Entolasia marginata</i>	Bordered Panic	Poaceae	U
<i>Entolasia stricta</i>	Wiry Panic	Poaceae	U
? <i>Hemarthria uncinata</i>	Matgrass	Poaceae	U
<i>Hierochloe rariflora</i>	Scented Holygrass	Poaceae	U
* <i>Holcus lanatus</i>	Yorkshire Fog	Poaceae	R (wet)
<i>Lachnagrostis filiformis</i>	Blown Grass	Poaceae	R (wet)
<i>Microlaena stipoides</i>	Weeping Grass	Poaceae	C
<i>Phragmites australis</i>	Common Reed	Poaceae	R (wet)
<i>Poa cheelii</i>		Poaceae	C?
<i>Poa ensiformis</i>		Poaceae	C (wet)

Scientific name	Common name	Family	Abundance
<i>Poa meionectes</i>		Poaceae	C (sheltered)
<i>Poa ?sieberiana</i> var. <i>sieberiana</i>		Poaceae	C?
<i>Poa ?tenera</i>		Poaceae	U
<i>Rytidosperma longifolium</i>	Curly Wallaby Grass	Poaceae	R (rocks)
<i>Rytidosperma pallidum</i>	Red-anther Wallaby Grass	Poaceae	U
<i>Rytidosperma pilosum</i>	Wallaby Grass	Poaceae	U
<i>Themeda triandra (australis)</i>	Kangaroo Grass	Poaceae	U (rocks)
* <i>Vulpia</i> sp.	Rat's Tail Fescue	Poaceae	R (rocks)
GRAMINOIDS			
<i>Baumea rubiginosa</i>	Soft Twig-rush	Cyperaceae	U (wet)
<i>Carex appressa</i>	Tall Sedge	Cyperaceae	U (wet)
<i>Carex breviculmis</i>		Cyperaceae	U
<i>Carex fascicularis</i>	Tassel Sedge	Cyperaceae	U (wet)
<i>Cyperus lucidus</i>		Cyperaceae	U (wet)
<i>Empodisma minus</i>	Spreading Rope-rush	Restionaceae	U (wet)
<i>Gahnia radula</i>		Cyperaceae	C
<i>Gahnia sieberiana</i>	Red-fruited Saw-sedge	Cyperaceae	U (wet)
<i>Isolepis habra</i>		Cyperaceae	U (wet)
<i>Isolepis inundata</i>	Swamp Club-rush	Cyperaceae	U (wet)
<i>Juncus ?planifolius</i>	Broad Rush	Juncaceae	U (wet)
<i>Juncus</i> sp.		Juncaceae	U (wet)
<i>Lepidosperma filiforme</i>		Cyperaceae	U (wet)
<i>Lepidosperma gunnii</i>		Cyperaceae	C
<i>Lepidosperma laterale</i>	Variable Sword-sedge	Cyperaceae	U
<i>Lomandra ?cylindrica</i>		Lomandraceae	U
<i>Lomandra filiformis</i> ssp. <i>coriacea</i>		Lomandraceae	U
<i>Lomandra filiformis</i> ssp. <i>filiformis</i>		Lomandraceae	C
<i>Lomandra glauca</i>		Lomandraceae	C
<i>Lomandra longifolia</i>	Spiny Mat-rush	Lomandraceae	C
<i>Lomandra multiflora</i> ssp. <i>multiflora</i>		Lomandraceae	C
<i>Luzula flaccida</i>		Juncaceae	C (sheltered)
<i>Schoenus apogon</i>	Common Bog-rush	Cyperaceae	C (wet)
<i>Xanthorrhoea concava</i>	Grass Tree	Xanthorrhoeaceae	R
<i>Xyris gracilis</i>	Slender Yellow-eye	Xyridaceae	U (wet)

QUADRAT DETAILS

No. in VIS	Field No.	Easting	Northing	Location	PCT
001	11	707532	5884515	N bank of Reef Creek, c. 100m upstream of W sit boundary	3212
002	98	709010	5884894	100m above Reef Rd opposite Phragmites swamp on Reed Ck	3451
003	81	709981	5885509	200m SE down ridge top from highest point of site, near W side	3221
004	80	709287	5886936	NW sector, 880m S of Imlay Rd on N side of 3 rd small drainage line	3449
005	96	709907	5887292	100m S of Imlay Rd, c. 700m E of White Rock River bridge	3901
006	90	710117	5886624	90m N of junction of Laings Rd and unnamed trail	3649
007	91	710978	5887131	Surveyors Gully c. 400m S of Imlay Rd	3194
008	95	711342	5886128	100m NE of old reserve road, , c. 350m in from where it leaves Laings Rd	3450
009	79	712207	5886500	N of Laings Rd, 200m N up E fork of new track, then 100m W into drainage line	3449
010	97	712399	5885572	c. 250m below Laings Rd, 400m NE of Reef Rd junction	3451
011	94	713273	5887048	c. 350m W along ridge from mid point of Link FT between Imlay Rd and Laings Rd	3449
012	93	713934	5886983	c. 250m E of Link FT half way between Imlay and Laings Roads	3648
013	92	714262	5887091	355m upstream of culvert on Imlay Rd, a bit W of gravel dump on S verge	3221
014	89	715714	5887400	c. 400m W of Nungatta Creek Rd, c. 1 km S of Imlay Road (outside site)	3648
015	86	715360	5885692	S side of granite outcrop 50m W of Sand Pad track	3666
016	85	716493	5884718	NE-facing slope 50m above Ricksons Creek & c. 100m SE of Sand Plot track (outside site)	3450
017	84	716949	5883640	Far side of Ricksons Creek, 800m W from Nungatta Creek Rd (outside)	3449 or 3452
018	82	713889	5885062	Sandy Creek flat 230m E of Camo's FT	3449
019	88	713737	5884314	c. 100m W of Camo's FT, c. 1.9 km S of Laings Rd	3666
020	83	713155	5884279	Donald Laings Creek flat 100m upstream of ford	3212
021	78	710393	5884813	Lower end of heavily logged ridge at end of old track c. 1 km in from Laings Rd above junction of Reef Ck and large tributary	3212

No. in VIS	Field No.	Easting	Northing	Location	PCT
022	87	710412	5884300	c. 200m N of Reef Road bend on ridge top	3450
023	99	708040	5883260	200m N of Merv's West FT	3450
024	15	707431	5884085	E side of ridge between Merv's West FT and Reef Creek	3452